

# Cost Justification of a Community Health Information Network: The ComputerLink for AD Caregivers

Fay Cobb Payton, Ph.D., Candidate, Management Information and Decision Systems

Patricia Flatley Brennan, Ph.D., RN, FAAN, Schools of Nursing and Systems Engineering

J.B. Silvers, Ph.D., Director of Health Systems Management Center and Department of Finance

Case Western Reserve University, Cleveland, Ohio

Supported by a grant from the National Institutes on Aging, AG 8617

## ABSTRACT

*Recent studies<sup>2,5</sup> examined the perceived benefits of the ComputerLink, a specialized computer network for caregivers of persons with Alzheimer's Disease. The ComputerLink existed as a special service within a free, public access community health information network. The issue of "free", however, is debatable. Though usage costs were not incurred by the AD caregivers who used ComputerLink, there are direct and indirect costs associated with these and other community networks. This study will focus on costs incurred at the individual level, recognizing that organizations and society also bear community network costs. At this level, the primary cost savings occur with the caregiver. The biggest factor determining net economic benefits is the extent to which this technology intervention delays or prevents institutionalization. Results of this analysis suggest that community health networks do return economic and social benefits to their users.*

## PROBLEM STATEMENT AND PURPOSE

The utilization of community networks to their users is more than often viewed as "free". There, however, are, costs and benefits associated with "free" public access networks. To date, a cost-benefit analysis of one community network, ComputerLink, has not been performed prior to this study. Because users of community networks are so diverse<sup>1</sup>, a Level of Analysis Model will be used to focus the cost-benefit at a single level: the individual. In the case of the ComputerLink, this is primarily the Alzheimer's Disease (AD) caregiver.

## LEVEL OF ANALYSIS MODEL

Markus and Robey<sup>4</sup> suggest that information technology impacts three levels of analyses: individuals, organizations, and society.

At the individual level, AD caregivers were the individual users of the ComputerLink. These users access The ComputerLink based on unique motivations and needs. System benefits, such as on-line support groups and 24-hour systems availability, and limitations, such as systems "lock-out" (i.e., the inability of users to access the system, usually when a system has reached its maximum user capacity), accrue only to a particular person one at a time.

At the organization level, benefits from the network for providing a service to a particular population accrue to a specific entity. Because ComputerLink existed as a research intervention, no specific organization benefited from its existence. If services, like the ComputerLink, were provided by health services agencies, such as managed care organizations, then an organizational level of analysis would appraise benefits to the managed care organization. These networks can provide assistance as well as pose limitations to an organization and its ability to service its clients.

Lastly, the societal level encompasses both individuals and organizations but attends to issues relevant beyond that specific to single persons or specific organizations. In addition, there are larger social costs (such as the redistribution of expenditures from one market sector to another) and social benefits (such as the development of a technological infrastructure or the emergence of new

models of care). This level of analysis, however, is beyond the scope of the ComputerLink study.

The cost-benefit analysis performed in this paper will focus on the individual level domain. Individuals include caregivers that used The ComputerLink during the experimental period of the study. By limiting the domain, problems with inappropriate level of analysis and mixed-level research strategies are avoided<sup>5</sup>. Furthermore, the primary decision-maker in this chronic care setting is the caregiver to the AD patient. The caregiver, or individual, is the most appropriate level for economic analysis.

#### **COSTS AND TRADITIONAL AD SERVICES**

AD places significant costs on patients, caregivers, society, and the health care community. The costs attributable to AD can best be described in terms of (in)formal services received by the patient. Because specific cost evaluations were not done during the original ComputerLink experiment, it is necessary to rely on costs from national studies to obtain estimates that can be used in a cost analysis.

Rice<sup>7</sup> determined that the total cost to care for community or institution-based AD patients in Northern California was \$47,000 per year. Hospital, nursing home, physician visits, medication, medical items, social services, and other costs (i.e., physical modification to the home and transportation to ambulatory care facilities) were considered formal services and were included in the above cost. These formal services had a mean annual total of \$12,572 and \$42,049 for community and institution-based patients, respectively.

The choice of the Rice<sup>7</sup> framework rests upon its most recent AD costs findings, the fact that it limited senile dementia to AD only, and its distinction between costs attributed to community-based as distinct from institution-based AD care. In addition, most of the patients cared for by the AD caregivers in the ComputerLink study were community-residing, thus permitting application of Rice's cost framework.

Table 1 shows the formal services and their associated costs of community-residing and institution-residing AD patients and their caregivers. These costs were taken from the Rice<sup>7</sup> study. These costs will be used to conduct the cost/benefit analysis of ComputerLink at the level of the individual.

**Table 1 Mean Annual Costs of Services Used By AD Patients and Caregivers in 1990 (\$/pt/yr)**

<i>Type of Services</i>	<i>Community Based Care</i>	<i>Institutional Based Care</i>
Hospital	\$ 1,648	\$ 496
Nursing Home	62*	38,980
MD Visits	459	632
Medical Items	472	1,426
Social Services**	9,585	35
Other***	114	110
Medication	232	371
<b>TOTAL</b>	<b>\$12,572</b>	<b>\$42,050</b>

**NOTE:** \* Patients that sought temporary nursing

\*\* Includes Day Care, Meals and Homecare

\*\*\* Includes Transportation

#### **COMPUTERLINK DESCRIPTION**

ComputerLink is a network-delivered, computer-based utility that provides health services to home-bound persons. This network represented the first effort to systematically replicate, for vulnerable populations, functions provided by formal support services: peer support, professional advice, education, and counseling. AD caregivers face complex demands in the presence of multiple health, socioeconomic, and emotional challenges<sup>2</sup>. To assist the home-based AD caregivers, ComputerLink provided caregivers with information resources via an Electronic Encyclopedia which contains AD facts, self-care techniques, and home-based management. Moreover, the network attempted to support caregivers through decision modeling<sup>1</sup>, a

communications module which facilitated public and private discussion among users via electronic mail and support group bulletin boards<sup>2</sup>. A project nurse served as a moderator of private correspondences from caregivers and bulletin boards that supported globally, relevant questions that were posted among caregivers.

Moreover, ComputerLink's capabilities offer several benefits to its users. The decision support functionality enables users to evaluate treatment, diagnoses and coping alternatives and behaviors based on their personal norms and values. The Electronic Encyclopedia contains factual disease-related and social, financial and medical service information available to patients and caregivers. Lastly, the communication pathway empowers users through its personal electronic mail and public bulletin board capabilities. However, the most important benefit to ComputerLink's users is its availability to reduce social isolation and the unpleasant social stigmas associated with AD.<sup>2,6</sup>

ComputerLink was delivered at no charge to the users and provided home care assistance to caregivers for persons with AD<sup>2</sup>. Caregivers accessed the network via Wyse 30 terminals and 1200 baud modems that were placed in their homes.

#### COMPUTERLINK COSTS

One hundred and two patients participated this study, and 47 were randomized to the experimental, ComputerLink group. Subjects in the ComputerLink group received in-home access to ComputerLink for a one-year period. Data were collected at pre- and post-experimental study periods, and at 11 monthly intervals during the evaluation. The implementation costs (See Table 2) associated with The ComputerLink linked were provided by Brennan. Since The ComputerLink resided on an existing community network (FreeNet), only modification costs were incurred by Brennan and her project team. All maintenance costs are incurred by the larger community network, FreeNet, thereby eliminating this cost of implementation.

Table 2

Table 2 ComputerLink Implementation Costs--Paid By Grant For 47 AD Patient Capacity for 1990

<i>Item</i>	<i>Total Amount</i>	<i>Cost Per Patient</i>
Terminals, Modems, and Power Supplies (47 @ \$350)	\$16,450	\$ 350
Full-Time Registered Nurse	\$32,000	\$ 681
Part-Time Employee	\$17,000	\$ 362
Telephone Lines (47 @\$15/mon for 1yr)	\$ 8460	\$ 180
10 Caregivers Adjusted Their Homes (i.e., PC Stand Purchase @ \$50)	\$ 500	\$ 11
Modifications To FreeNet	\$10,000	\$ 213
<b>TOTAL Costs</b>	<b>\$84,410</b>	<b>\$1,797</b>

Several points are noteworthy about the data shown in Table 2. Each of the items represent a one-time charge for initial implementation of the ComputerLink and were incurred by a "pseudo" organization - Brennan, et al.<sup>2</sup> and their research team. Further, these costs were incurred for the establishment of the intervention and paid by a grant. After the first year, telephone costs were the responsibility of the caregiver. The initial project assumes that the caregiver will pay for these telephone costs after the first year. Caregivers were also responsible for any home modifications as shown in Table 2 as \$500 for roughly 20% of the sample size (i.e., 10 caregivers).

If there is no such intermediary (i.e., like pseudo organizations) to establish the technical base for systems like ComputerLink, these systems probably would not be established or would be limited in implementation. One could argue that these implementation costs are entirely irrelevant for analysis at level 3 (society) but not for level 1 (AD caregivers). In this analysis, these implementation costs will be included since the future replications are likely to incur similar expenditures (e.g., which may be absorbed by an individual(s) or grantor).

Table 3 summarizes the costs incurred by the ComputerLink for Years 1-5. Terminal, modem, home adjustments, and FreeNet modifications are first year startup costs only and therefore do not appear in the costs listed in Years 2-5. The remaining costs are held constant for the 47 AD patient capacity and over the remaining period. After Year 1, the full-time nurse and part-time employees were no longer used by the project, and these costs are removed in the analysis.

Table 3 ComputerLink Costs Per AD Caregiver

<i>Item</i>	<i>Costs</i>
Total ComputerLink Implementation Costs @ 47 Patient Capacity @ Year 1	\$ 84,410
Cost Per Patient @ Year 1	\$ 1,797
Total ComputerLink Costs @ Year 2:	\$ 8,460
Yearly Cost Per Patient @ Years 2-5	\$ 180

#### DATA ANALYSIS FROM THE COMPUTERLINK SAMPLE

To measure the impact of The ComputerLink on AD caregivers, project data were analyzed to answer the questions in the Rice<sup>7</sup> framework of services including nursing home visits, physician visits, social services and medical items including prescriptions. Unit costs were adopted from Rice.

Data were obtained in the 11 monthly interviews for a cost analysis. The mean ComputerLink access time was used to determine connection costs (e.g., on the ComputerLink). Tables 4 and 5 show the mean numbers for each of these items. Table 6 shows a summary of the total costs associated with community-based AD patients.

Table 4 Mean Items for 47 ComputerLink Users

	<i>Mean Units /pt/yr</i>	<i>Cost Per Unit</i>	<i>Est. Annual Cost/pt/yr</i>
Network Connect Tim	17.86 min (sd=16.98)	\$0.15/min*	\$2.68
MD Visits	8 visits ** (sd= 7.72)	\$459	\$3,672
Daily NH Placement	3	\$62	\$186

\* Regional Telephone Estimate For Residence

\*\* Based on n=47 w/4 mean visits (semiannual); mean & s.d. were multiplied by 2 for comparisons

Table 5

Mean # Social Services Used & Costs Per Year: Community-Based Care

<i>Mean Service Count For Each Month Used</i>	32 (sd=17)
Mean Cost Based On Rice [(\$9585/12)*11]	\$8786
Total Social Services Costs (\$8786*47)	\$412,942
Cost Per Patient (\$412,942/47)	\$8786

Table 6 Summary: Total Costs of ComputerLink (CL) and AD Costs Incurred By Caregivers Per Year

	<i>Costs Per Patient @ Year 1</i>	<i>Costs Per Patient @ Years 2-5</i>
CL Access	\$ 2.68	\$ 2.68
MD Visits	\$ 1,836.00	\$ 1,836.00
NH Placement	\$ 186.00	\$ 186.00
Social Service	\$ 8,786.00	\$ 8,786.00
CL Implement.	\$ 1,797.00	\$ 0.00
TOTAL COST	\$ 10,773.00	\$ 8,976.00

**NOTE:** In Year 2, the TOTAL COST decreases by the implementation, hardware, and personnel costs.

Given this analysis, the ComputerLink costs are less than the traditional community-based care costs by \$1,799 (\$10,773 from Table 6 - \$12,572 from Table 1). This comparison rests on the similarity of the Brennan, et al.<sup>2</sup> and Rice<sup>7</sup> subjects. In Year 2, ComputerLink shows a further savings of \$12,572 less \$8,976 (from Table 6), or \$3,596. The full cost of implementation can be recovered within one year.

A closer examination of ComputerLink and institution-based costs shows savings associated with ComputerLink. For Year 1, ComputerLink generates a savings of \$42,050 less \$10,773, or \$31,277 over institution-based care. In Year 2, the savings increases to \$33,074 (i.e., \$42,050 less \$8,976). Further, the data showed that three nursing home placements occurred among ComputerLink users and four within the control group. Thus, the rate of change is 3/47 or 6% and 4/55 or 7% for the intervention and control groups, respectively. This 1% represents the change in institutional-based cost savings experienced by the ComputerLink users. If ComputerLink results in deferring or eliminating institutionalization, then its value is clear. Even if it only maintains community-based care much as would have occurred anyway, the reductions in other costs offset implementation expenses very rapidly.

## DISCUSSION AND LIMITATIONS

Individual costs savings are likely to occur within two years of the establishment of services like ComputerLink. Cost savings occur because of a reduction in the use of traditional services. It is unlikely that interventions, like ComputerLink, will prevent all nursing home admissions, and sometimes nursing home admissions is an appropriate treatment choice for persons with AD. However, where home-based care is desired by the person or caregiver, it is likely that interventions, such as ComputerLink, will aid in promoting the chosen site of care without increasing the costs associated with it. Moreover, the intangible

benefits, such as social support, timely and adequate service utilization, to caregivers and AD patients should not go unrecognized.<sup>5</sup> ComputerLink and other community health information networks have the potential to return benefits at each level of analysis: individual, organization and society.

However, this research is not without limitations. The analysis was done based a small sample size of 47 AD patients. National costs were assigned to a local intervention, perhaps underestimating the local costs. Several costs were held constant throughout the analysis. Actual costs and their associated determinants, would change the figures estimated. Despite these limitations, the results of this cost analysis indicate that community networks, like ComputerLink, are good investments if they defer or eliminate institutionalization and improve the quality of care. Steven McConnell, of the Chicago-based Alzheimer's Association, responded to the results of the Rice study and the escalating costs for AD caregiving. "There's a real need for expansion of home and community-based".<sup>3</sup>

## References.

1. Aria, G and Ginzberg, M. DSS Design A Systemic View of Decision Support Comm of the ACM. 1985; 28:10:1045-1052.
2. Brennan, PF, Moore, S and Smyth, K. ComputerLink: Electronic Support for the Home Caregiver. Advance Nurs Science. 1991;13:4:14-27.
3. Burns, J. Alzheimer's Care Costs Same in a Facility or at Home. Modern Healthcare. 1993.
4. Markus, ML and D Robey. Information Technology and Organization Change: Causal Structure in Theory and Research. Mgmt Science. May 1988; 34:5:583-598.
5. Payton, FC, and Brennan, PF. Perceived Benefits of a Community Network. Unpublished Paper, 1994.
6. Payton, FC, Brennan, PF, and Ginzberg, M. Needs Determination For A Community Approach To Health Care Delivery. International Journal of Technology Management. 1995:157-174
7. Rice, DP. DataWatch - The Economic Burden of Alzheimer's Disease Care. Health Affairs 1993: 165-176.